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Studies on genetic variability, heritability and genetic advance in fenugreek (*Trigonella foenum-graecum* L.)

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Absract

The present investigation was carried out with fenugreek genotypes obtained from different coordinating centers of AICRP on Spices. Pods per plant (36.5 and 34.61), number of seeds per pod (22.86 and 21.20) and seed yield (22.09 and 17.21) recorded highest coefficients of variation (both phenotypic and genotypic), while it was low for pod length (11.43 and 7.32). Heritability estimates were high for plant height (83.10), pods per plant (89.90) and seeds per pod (86.00). Seed yield (60.70) and branches per plant showed moderate estimates of heritability. The characters viz. plant height, pods per plant, seeds per pod and seed yield which recorded high heritability also showed high genetic advance indicating operation of additive gene action in the inheritance of these traits. These studies indicated that selection may be worthwhile in fenugreek for number of pods per plant, seeds per pod besides plant height for achieving higher yields.

Keywords: Geneticvaniability, fenugreek, heritability

Fenugreek (*Trigonella foenum-graecum* Linn.) is one of the important minor spices in the country grown in an area of about 35732 ha producing 35737 t of grain with a productivity of 1000.1 kg ha-1. The major fenugreek producing states are Madhya Pradesh, Haryana, Rajasthan, Gujarat, Maharashtra, Uttar Pradesh, Punjab, Bihar and Andhra Pradesh. In addition to its use as spice, leafy vegetable and fodder, it has medicinal value too. To formulate efficient breeding programmes, knowledge about the presence of genetic variability for yield and yield component traits is essential. Superior genotypes can be isolated by selection, if considerable genetic variability exists in the population. Besides genetic variability, heritability and genetic advance also plays a crucial role for the improvement (genetic gain) of any character. Very little information is available in this direction on fenugreek. Keeping this in view, an attempt was made in the present investigation to find out the magnitude of variability, heritability and genetic advance for different characters in Fenugreek.

Twelve diverse genotypes of fenugreek obtained from different coordinating centers of AICRP on Spices under multi location testing were evaluated during rabi seasons of 1998-99, 1999-2000, 2000-01 and 2001-2002 in a randomized block design with three replications at Regional Agricultural Research Station, Lam. The plot size with a spacing of 30 x 10 cm consisted of four rows

of 5 m length. The characters included for the present study are plant height (cm), primary branches per plant, pods per plant, pod length (cm) and seed yield (q ha^{-1}). Five competitive plants at random were selected for recording the data. The data collected over four years was subjected to statistical analysis individually year wise as well as pooled over four years for estimating genetic variability, heritability, genetic advance and genetic advance as percent of mean. The analysis of variance for the design was carried out following Panse and Sukhatme (1978). Phenotypic and genotypic coefficients of variation were estimated according to Burton (1952). Heritability in broad sense, genetic advance (GA) and genetic advance as percent of mean (GAM) were worked out using the formula suggested by Allard (1960).

The analysis of variance revealed significant differences for all the characters in all the individual seasons as well as in pooled over seasons, indicating the presence of genetic variability in the material. The estimates of mean, range, phenotypic and genotypic coefficients of variation, heritability, genetic advance and genetic advance as percent of mean over four seasons are presented in Table. 1. The mean values for six characters are presented in Table 2.

Table 1. Range, mean, heritability, genetic advance and genetic advance as percent of mean

Character	Range	Mean	PCV	GCV	Heritability	GA	GAM
Plant Height (cm)	30.13 - 47.50	36.31	16.89	15.39	83.10	10.67	29.38
Branches per plant	4.01 - 6.14	16.21	5.12	12.27	57.30	1.01	19.70
Pods per plant	11.77 - 33.42	19.21	36.50	34.61	89.90	13.74	71.51
Pod length (cm)	8.06 - 10.43	9.08	11.43	7.32	41.00	0.87	9.58
Seeds per pod	8.84-14.51	10.83	22.86	21.20	86.00	3.48	32.13
Seed yield (q ha-1)	5.44 -10.84	7.53	22.09	17.21	60.70	3.06	40.63

The phenotypic coefficients of variation (PCV) ranged from 15.12 for branches per plant to 36.50 for pods per plant. While the genotypic coefficients of variation (GCV) varied from 7.32 (pod length) to 34.61 (pods per plant). Number of pods per plant showed highest coefficients (both phenotypic and genotypic) of variation indicating greater diversity among the varieties for the trait. Mehta *et al*. (1982), Reddy *et al*. (1991), and Arora and Lodhi (1993) also reported highest phenotypic and genotypic coefficients of variation for number of pods per plant in fenugreek. Seeds per pod and seed yield also showed relatively high coefficients of variation. These results are in agreement with the results reported by Mehta *et al*. (1982), Reddy *et al*. (1991) and Arora and Lodhi (1993). In general, the differences between PCV and GCV were high for branches per plant, pod length and seed yield indicating that these traits were much influenced by the environment. While the differences between PCV and GCV were less for pods per plant and seeds per pod indicating that these traits were not much influenced by the environment, thus suggesting ample scope for improvement. Pod length showed lower values of PCV and GCV indicating the narrow range of variability.

For the improvement of any character, variation is necessary in that trait. The expression of the character depends upon the degree of variability (both phenotypic and genotypic) present for that particular trait. Nevertheless, genotypic coefficient of variation is found to be more useful than phenotypic coefficient of variation for the estimates of variability as it depends more on the heritable portion of variability. These results in the present study indicated that there is a scope for improving these traits by

Table 2. Mean performance of fenugreek for six characters over four years

Variety	Plant Height (cm)	No. of branches per plant	No. of pods per plant	Pod length (cm)	No. of seeds per pod	Seed yield (q ha-1)
RM-1	32.34	6.02	16.10	8.88	10.25	7.03
HM-305	33.23	5.01	14.73	8.62	9.39	6.63
HM-346	32.47	4.89	12.29	8.06	8.89	5.78
HM-350	35.04	4.01	15.30	8.96	10.55	6.84
JF-195	37.20	4.93	19.45	9.32	11.47	7.89
JF-204	44.47	4.98	30.05	10.15	13.60	9.97
JF-210	47.50	4.30	33.42	10.43	14.51	10.84
UM-321	36.97	6.14	21.83	8.76	10.02	7.87
UM-322	32.70	4.98	15.27	8.61	9.28	6.40
UM-323	30.13	4.77	11.77	8.57	8.84	5.44
UM-324	35.44	5.64	19.13	9.19	10.95	7.46
Lam Selection 1	38.24	5.82	21.23	9.43	12.22	8.28
General Mean	36.31	5.12	19.21	9.08	10.83	7.53
C.D.(0.05)	3.97	0.33	1.63	0.58	0.8	38.3

practicing simple selection as considerable amount of variation is present in the material.

The heritability in the broad sense ranged from 41.0 (pod length) to 89.9 (number of pods per plant). Heritability estimates were found to be high for plant height, pods per plant and seeds per pod. High estimates of heritability indicate these amenability of the traits in selection process. Seed yield and branches per plant showed moderate estimates of heritability. Pod length exhibited low heritability. Johnson *et al*. (1955) indicated that a high heritability is not always an indication of high genetic gain. Swarup and Chaugale (1962) also showed that high heritability is not always an indicator of genetic gain. The expected genetic advance would be low when the heritability is mainly due to non-additive gene effect, but the genetic advance would be high when the heritability is due to additive gene effect (Panse, 1957). High heritability and high genetic advance are crucial for the improvement (genetic gain) of any character. The characters viz. plant height, pods per plant, seeds per pod and seed yield, which recorded moderate to high heritability, also showed high genetic advance indicating the operation of additive gene action in the inheritance of these characters and giving scope for improvement through selection. These results are in agreement with the results reported by Mehta *et al*. (1982), Reddy *et al*. (1991) and Arora and Lodhi (1993). Pod length, which recorded low heritability as well as low genetic advance indicating the non-additive gene action. Similar results for pod length were reported by Reddy *et al*. (1991) and Arora and Lodhi (1993).

Considering the estimates of heritability and genetic advance in the present study, it is worthwhile to carry out selection in fenugreek for pods per plant, seeds per pod, plant height and ultimately seed yield for achieving high yields in fenugreek.

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